

# **LBNL Design Guidelines for Laboratory Furniture (3/30/15)**

**These guidelines apply to laboratory casework (bench tops, shelves and under counter storage), computer carrels, and stools.**

## **Furniture Design Principles**

Proper laboratory and work bench design requires consideration of the ergonomic impact on the worker. Considerations such as future adaptations, equipment changes, variability in individual worker size and changes in tasks should be factored into the Lab design. Ideally, all Lab furniture would allow for future adaptability/modification without posing significant cost, demolition or disruption of work.

Whenever possible, it is recommended that a 3D drawing and a furniture mockup be made available for end-users to thoroughly assess the design elements and adjustment features prior to purchase. This is especially important when lab furniture involves custom fabrication of casework; which most labs do.

A process that integrates key decision makers, e.g., health and safety, end users, facilities design and building maintenance, into the design team should be used to determine the best furniture design to support lab functions and user needs.

The Project Manager for the new or remodeled laboratory is advised to seek assistance from the LBNL Ergonomist early on in the design process.

## **Executive Summary**

Laboratory furniture and casework must be sturdy, and capable of supporting anticipated loading and varied uses. Adjustable, modular and/or mobile casework should be used for future flexibility. Furniture and casework should be designed with ergonomic considerations (e.g., adjustable work surface heights, adequate knee clearances for seated work, adequate toe clearances for standing work, shelving heights, etc.). These precautions can help reduce the likelihood of ergo-related injuries and enhance work performance in the laboratory.

For the purpose of accommodating human factors, e.g., people's sizes, and the functional requirements of lab equipment, we recommended that a minimum of 50% of lab work benches and equipment benches be height adjustable either by the user or by installers. When feasible and possible up to 100% of lab benches should be height adjustable for maximum versatility and future cost avoidance associated with remodeling. For the purpose of meeting ADA requirements, at least 10% of lab work benches and equipment benches should be height-adjustable to meet wheelchair access guidelines.

Note: Since a lab may consist of a mix of both "adjustable" and "fixed" benches, we propose metrics and design criteria for both types of furniture in this guideline.

Optimal lab work benches specifications are found in Sections 1a (Work Benches) and 3a (Equipment Benches).

Optimal computer carrel specifications are found in Section 4a.

Optimal chair specifications are found in Section 8.

## 1. Lab Work Benches

For purposes of these guidelines, **“work benches”** are work counters that will likely be staffed by employees to conduct their experiments. Adjustability of work benches is needed to accommodate people’s sizes and to meet ADA requirements in the laboratory.

It is also important to consider the “vision” and “reach” demands of the tasks when determining the optimal height for work benches. For example, sustained tasks with precision, e.g., microscopy or computer analysis are best performed sitting on a stool while dynamic tasks, e.g., plate handling or pipetting that require reaching, are best performed in a standing position. Thereto, the heights of hand tools and instruments people work with, e.g., pipettes, vials, centrifuges, must also be considered since they too affect the optimal working height of the bench. Due to the many factors that affect working height, it is highly recommended that a minimum of 50% of work benches be adjustable by users or installers.

Additionally, ample work surface area to accommodate tools/equipment and to carry out tasks must also be considered.

Ideally, equipment benches would be modular in size (limited number of sizes), using the smallest kit of parts to allow for long-term adaptability and reuse. Since the lab may consist of a mix of both “adjustable-height” and “fixed-height” benches, we offer the following metrics and optimal and acceptable design criteria:

### **1a. “Adjustable-Height Work Bench Metrics- See Diagrams 1, 1a and 1b Optimal Adjustment Ranges and Features (meets ADA and human factors)**

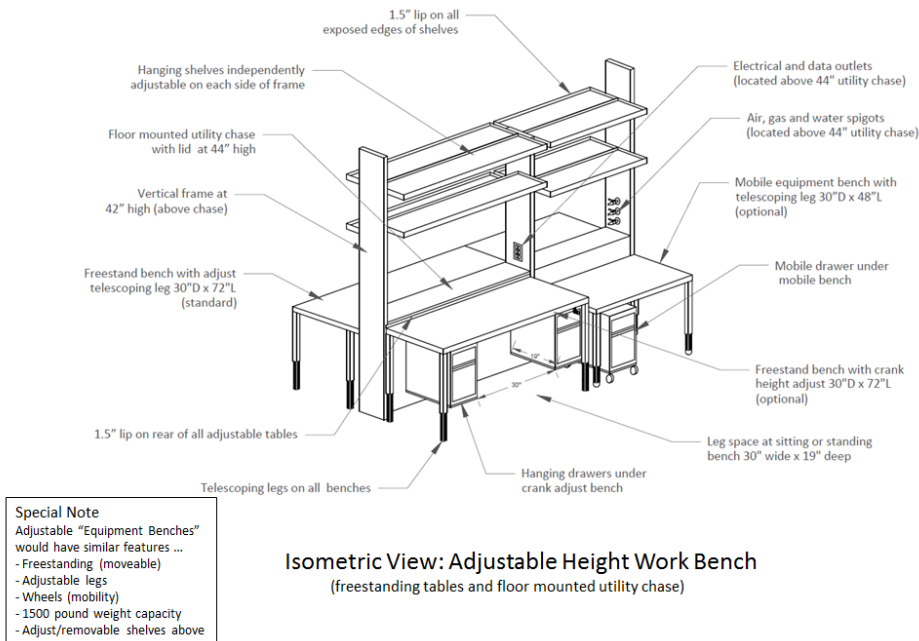
- User-adjustable- Electric or Crank mechanisms
- “C” and “T” leg design options
- Sit to stand counter height range 28” to 44” inches (16” range)
- Knee space at sitting or standing bench 30” wide x 19” deep
- No counter aprons or drawers at working position to ensure leg/thigh clearance
- If using floor mounted chase consider whether a one inch splash sill should be installed along the rear section of the bench to protect electrical and data cables.
- Shelving shall have a 1 1/2” lip on all sides to provide restraint for chemicals.
- Task lighting should be considered based on the visual needs of the employees.
- Bench Length: 72” modules
- Bench Depth: 30” minimum
- Weight capacity: 750 pound minimum
- Mobile locking casters (as needed)

### **Acceptable Adjustment Ranges and Features (meets ADA)**

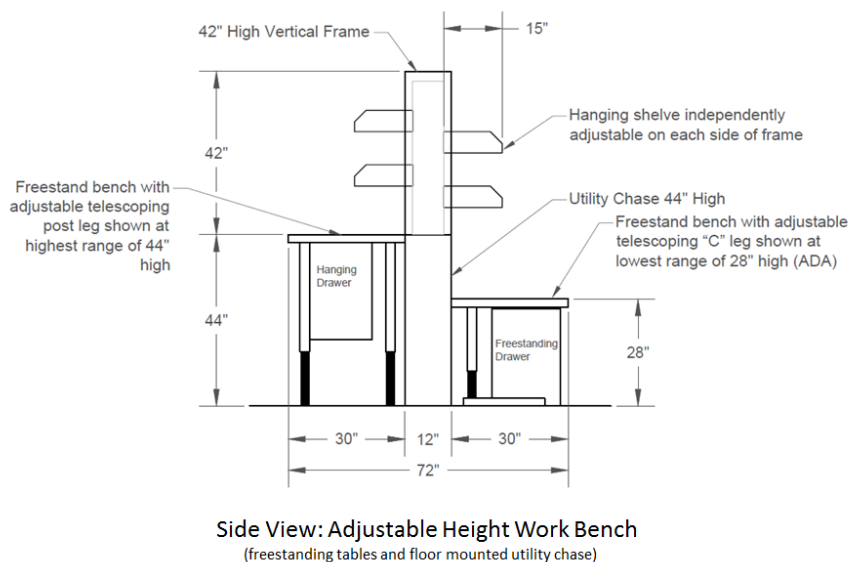
- Maintenance Adjustable- Telescoping Legs or Panel-Hung Cantilevers
- Four post and “C” (recessed) leg design options
- Sit to stand height range 28” to 40” inches (12” range)
- Knee space at sitting or standing bench 30” wide x 19” deep

- No counter aprons or drawers at working position to ensure leg/thigh clearance
- If using floor mounted chase consider whether a one inch splash sill should be installed along the rear section of the bench to protect electrical and data cables.
- Bench Length: 72" modules
- Bench Depth: 30" minimum
- Weight capacity: 750 pound minimum

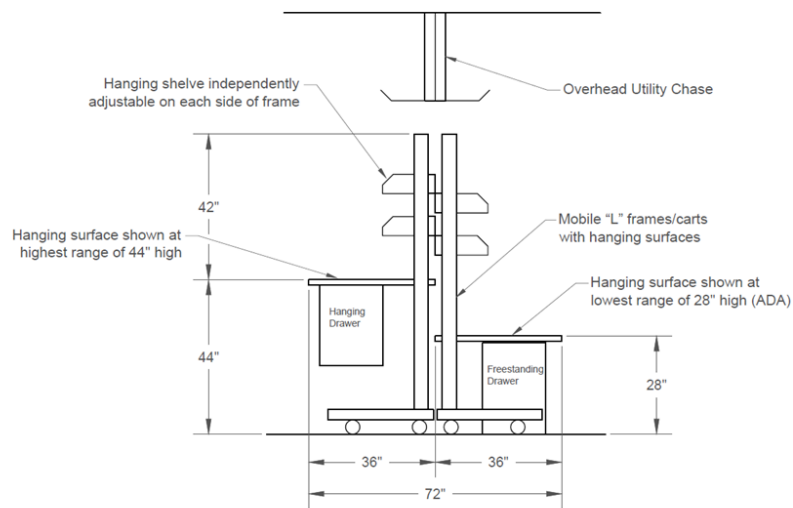
## Diagram 1. Adjustable Height Work Bench



## Diagram 1a. Adjustable Height Work Bench



## Diagram 1b. Adjustable Height Work Bench



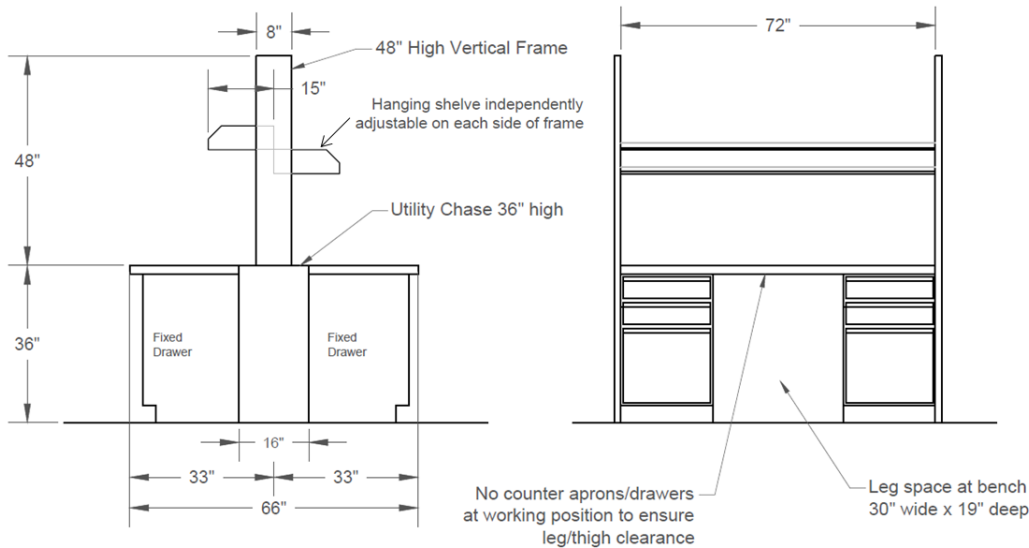
Side View: Adjustable Height Work Bench  
(frames with hanging components and ceiling mounted utility chase)

### 1b. "Fixed-Height" Work Bench Metrics- See *Diagram 2*

- Standing height bench at 36" high at top of counter
- Knee space at sitting or standing bench 30" wide x 19" deep
- No counter aprons or drawers at working position to ensure leg/thigh clearance
- Toe space at standing bench 4" high x 4" deep at cabinets/drawers
- Shelving shall have a 1 1/2" lip on all sides to provide restraint for chemicals.
- Task lighting should be considered based on the visual needs of the employees.
- Laboratory equipment layouts should avoid placement of equipment in the bench knee space
- Bench Length: 72" modules
- Bench Depth: 30" minimum
- Weight capacity: 750 pound minimum
- Mobile locking casters (as needed)

Note: The fixed height work bench metrics detailed above DO NOT meet ADA requirements. ADA benches must accommodate a range within 28" to 34" to top of counter; hence, fixed benches should always be augmented with a few height-adjustable, ADA-compliant benches in the lab.

## Diagram 2. Fixed Height Work Bench



Side and Front Views: Fixed Height Work Bench  
(casework below/vertical frames above and floor mounted utility chase)

## 2. Lab Equipment Benches- See *Diagrams 1,1a and 1b*

For the purpose of these guidelines, **“equipment benches”** are work surfaces that are designated for lab machines that are used by multiple staff. These machines might include but are not limited to microscopes, hoods, pickers, sequencers, autoclaves, centrifuges, analyzers, lasers and computers. Since these machines can vary in size/weight from a bread box to a refrigerator, the heights of equipment benches will need to be adjustable to ensure they can be set at proper functional heights. Since lab employees can be using these machines for several hours per day, it is essential that machines be installed at heights that will fit most people. Thereto, lab usage and lab machines are ever-changing so benches must be flexible enough to adapt over time. A variety of counter sizes might also be required to accommodate smaller/larger machine footprints. Some instruments like analyzers that are equipped with computers might need to be on portable benches with wheels. If equipment must be periodically serviced from the sides or rear, the bench might also require (lockable) wheels. Microscopes of greater than 40X power will require a special anti-vibration bench.

Ideally, equipment benches would be modular in size (limited number of sizes), using the smallest kit of parts to allow for long-term adaptability and reuse for both equipment

or people. The metrics below are offered for application of standard lab machines on equipment benches.

**Special Note:** “Equipment benches” would have similar design features as those of “work benches” but with greater emphasis on mobility/movability (wheels, glides) for service access and increased weight capacity for heavier machines. Seismic anchoring may be required for mobile lab benches. Further details can be found in [Requirements and Policies Manual- Seismic Safety](#) and [Lateral Forces Specifications](#).

### **3a. Adjustable-Height Equipment Bench Metrics: See Diagram 1 Acceptable Adjustment Ranges and Features (meets ADA)**

- Maintenance Adjustable- Telescoping Legs
- Four post leg or “C” leg (recessed) design options
- Sit to stand counter height range 26” to 38” inches (12” range)
- Knee space at standing bench 30” wide x 19” deep (as needed)
- Toe space at standing bench 4” high x 4” deep (if cabinets below)
- No counter aprons or drawers at working position to ensure leg/thigh clearance
- If using floor mounted chase consider whether a one inch splash sill should be installed along the rear section of the bench to protect electrical and data cables.
- Bench Length: 48” and 72” modules preferred (or as needed)
- Bench Depth: 30” to 36” inches
- Weight capacity: 1500 pound minimum
- Mobile locking casters (as needed)

### **3b. “Fixed-Height” Equipment Bench Metrics**

- Standing height bench at 36” high at top of counter or special height determined by equipment size
- Knee space at sitting or standing bench 30” wide x 19” deep
- No counter aprons or drawers at working position to ensure leg/thigh clearance
- Toe space at standing bench 4” high x 4” deep at cabinets/drawers
- Bench Length: 72” modules
- Bench Depth: 30” minimum
- Weight capacity: 1500 pound minimum

Note: The fixed height work bench metrics detailed above DO NOT meet ADA requirements. ADA benches must accommodate a range within 28” to 34” to top of counter.

## **4. Lab Computer Carrels - See Diagram 4**

For purposes of these guidelines, “**computer carrels**” are designated workstations that are staffed by employees to conduct data entry, analysis and research work at their computers. Computer carrels are to be located adjacent to but outside the lab so people are not encumbered with PPE such as safety glasses, gloves, lab coats as they work at

the computer. LBNL furniture standards for carrels are user-adjustable electric sit/stand desks to accommodate the variability in people's sizes and the high degree of staff churn. In most cases, computer carrels will also be equipped with a side table and mobile box/file drawer.

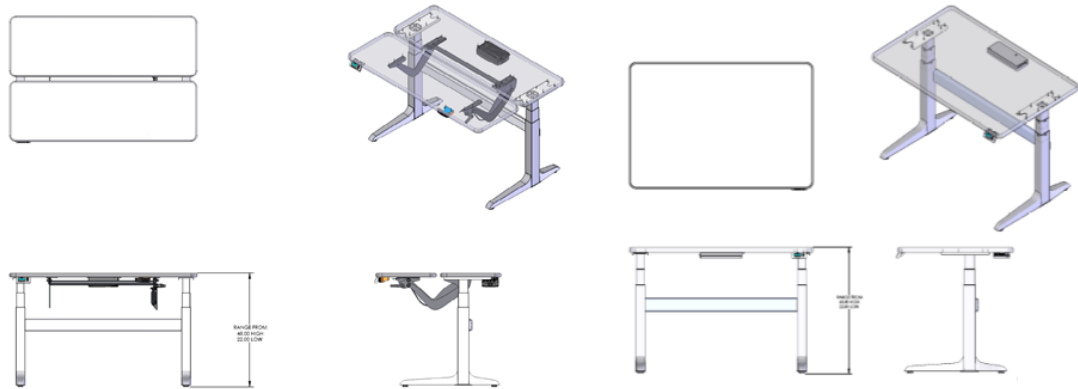
In some cases, hoteling or temporary computer stations might also be required for guests and students. These stations are most often equipped with low-cost tables but should include some level of adjustability, e.g., telescoping leg or crank and should be at least 30" deep to accommodate a desktop computer display and input devices.

Additional details can be obtained at: [LBNL Facilities Office Furniture Standards](#) and [LBNL Office Furniture Policy](#).

#### **4a. Computer Carrel Metrics**

- Sit-to-stand desk height range of 24" to 48" inches
- Surface depths 30" minimum
- Surface length 48" inches
- Single-level or bi-level desk options should be offered. Bi-level desk options are preferred since they provide the greatest versatility and minimize the need for additional accessories such as monitor arms and keyboard trays. Single-level desk options may require use of a monitor arm and keyboard tray. Single-level desks can be most helpful if there is limited work space and the desk needs to be used also for reading and writing materials.
- Work surface adjustment mechanism: User-adjustable electric
- Angle adjustment controls to be ratchet handle (versus knob) on bi-level desks
- Edges and corners of the work surface should be rounded (minimum radius of .01/3mm inches and have a non-reflective surface.

## Diagram 4. Laboratory Computer Carrels



Bi-level Electric Sit-stand Adjustable Desks  
32" deep x 48" wide

Single-level Electric Sit-stand Adjustable Desks  
32" deep x 48" wide

Input and display platforms each 15" deep  
Input Platform adjusts 6" up/down and tilts  
15 degrees positive / negative tilt

### 4. Utility Chases

- Flexible and adjustable work benches will work with both floor-mounted and overhead utility chases. Overhead utility chases are preferred since they offer greater flexibility.
- The utility controls/spigots/outlets should be placed within easy reach and should be located on vertical frames above the utility chase so as not to limit height adjustment of work counters at benches.
- A floor-mounted chase at adjustable bench locations should be minimum of 44" high so as to align with the highest position of adjustable counters. This would protect the chase in the event of liquid spillage and ensure that utility controls/spigots/outlets are located on vertical frames above the counter. Verify chase location does not conflict with planned bench top equipment. **See Diagrams 3 and 3a**
- If utilities are delivered entirely via drop-downs from an overhead chase and no floor-mounted chase is required, there is no such height requirement.
- Access plates to the utility chase should be removable with benches in place.
- Considerations should be made for the data and electrical needs of the lab area; including the spacing and quantity needed to accommodate cord length of equipment and user needs.

### 5. Benchtop Fit & Finishes

All work surfaces (e.g., benchtops, counters, etc.) shall be impervious to the chemicals and materials used in the laboratory, cleansers and disinfectants, and should be stain resistant.

- Benchtops should be epoxy or phenolic resin
- Benchtops should be gray in color and have a non-reflective matte finish
- Benchtop edges and corners to be rounded (minimum radius of .01 inch/ 3 mm)
- Adjustable benches that are independent of the utility chase must have a 1.5" splash sill at the rear of the counter to contain spills
- Work surface shall be 25mm (1") thick.
- A 1/8 inch grip groove should be provided on the underside of the counter top approximately 1 inch from the edge.

## 6. Shelves

Shelves above work and equipment benches should be independently adjustable on 1" increments on each side of the center vertical frame. All overhead shelves should be removable. Shelf depths should be sized based on the materials stored above and equipment placed on the work bench below. All shelves shall have a passive restraining system such as seismic shelf lips (1½" inch or greater) at all exposed sides. The shelves shall be firmly fixed so they cannot be vibrated out of place and allow the shelf contents to fall.

## 7. Undercounter Storage

Undercounter storage should be able to be added or removed from the bench and should either be mobile with locking casters or hanging from the bench. Any fixed or floor mounted storage should have a 4" x 4" toe space.

Drawers and cabinets should be located to the far right and left of the bench to ensure that there is adequate leg clearance (30" wide x 19" deep) at the point of operation at the center of the bench. Storage design should be based on the materials and equipment being stored and ideally include drawer and cupboard options.

## 8. Chairs/Stools

In all cases, the lab stool must include seat height adjustment, seat depth adjustment and backrest height adjustment to fit the user.

*Chairs/Stools Features:*

<b>Features</b>	<b>Specifications</b>
1. Seat Height Range (Standing Height Benches 36 inches or higher)	1. 25-33 inches.
2. Seat Height Range (Sitting Height Benches: 28-34 inches)	2. 16-23 inches.
3. Seat Depth	3. At least 2.5 inches of seat pan adjustment.
4. Backrest	4. Height and depth adjustable
5. Armrests	5. Armrests are not advised for most lab stools since they can hinder moving

	close into the bench.
6. Footring	6. Required since there is limited ability for foot contact with the floor.
7. Casters	7a. Soft wheel casters are required for hard floor surfaces. Additionally, locking casters might be required if hard floor surfaces are not level or are purposely sloped. 7b. Hard wheel casters are required for carpeted floor surfaces.
8. Fabric	8. Fabric must be upholstered vinyl fabric since lab stools/chairs may need to be cleaned and disinfected periodically.

**Additional Notes:**

**Seat Contour:** Since vinyl has a low coefficient of friction, this often presents problems with users sliding off the seat pan, compounded by the lack of foot contact and by the use of lab coats which exacerbate the issue of sliding off the seat pan. For these reasons, it's very important that lab stools include seat pan contouring that engage the buttocks/thighs (bucket type seat contours) to reduce sheer as well as a level (versus forward tilted) seat pan angle. In cases where thigh or leg clearance at lab benches present a problem (counter aprons or cabinets below), stools with saddle type seats might be required to allow the sitter's knees to drop allowing them to work closer to the bench. This can compensate for inadequate thigh space and knee/foot depth at benches, hoods and sinks.

Through trial and error and use-testing studies over the last 8 years, the LBNL Ergo Team has found that the Soma Comfort stool with bucket seat contours (pictured below) is the preferred lab stool. Similarly, the Ergo Team has found the Hag Capisco stool with saddle seat contours (pictured below) is the preferred lab stool for users working at benches with limited leg/thigh clearances.

A mix of 80% bucket seat contoured stools and 20% saddle seat contoured stools is highly recommended.

Customers and architects are free to choose alternate stool designs so long as they meet the above criteria. However, it is strongly advised that samples of such alternatives are provided for use-testing by lab staff and by the Ergo Team. **See Diagram 5.**

## Diagram 5. Lab Stools- Vinyl Upholstery and Footring

Soma Comfort Stool  
*Lab Standard*



Features & Specifications

- Bucket seat contours
- Seat height range 25" to 33"
- 2.5" depth adjust via seat slider
- Height and angle adjust backrest
- Adjustable footring
- Soft wheel casters
- Black vinyl upholstery

Available e-Buy Staples RTO Site

Hag Capisco Stool  
*Lab Special*



Features & Specifications

- Saddle seat contours
- Seat height range 22" to 32"
- 2.5" depth adjust via seat slider
- Height adjust backrest
- Adjustable footring
- Soft wheel casters
- Black vinyl upholstery

Available e-Pro One Workplace

### Resources:

- University of California Environment, Health and Safety
- Laboratory Safety Design Guide Second Edition September 2007 - University of California Industrial Hygiene Program Management Group
- Harvard University EH&S Guidelines for Design Revision Date: 10/15/12 Copyright 2012, President and Fellows of Harvard College
- Kodak's Ergonomic Design for People at Work 2<sup>nd</sup> Edition
- Department of Justice September 15, 2010 [2010 ADA Standards for Accessible Design](#)
- Facilities- Appendix A to Part 36- Standards for Accessible Design